PANCYTOPENIA

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Peripheral Blood

- **Anemia**
- **Leukopenia**
- **Thrombocytopenia**

Bone Marrow

- **Normocellular**
- **Hypocellular**
- **Hypercellular**

‘Involvement is primary or secondary’

Basics

- **Not a disease by itself**
- **Hematological/Nonhematological in origin**
- **Congenital/Acquired**
- **Single/Multiple mechanisms operate**
- **Any age**
- **Both sexes**
- **C/P is of pancytopenia/underlying disease**

MECHANISMS

I) Peripheral destruction (or sequestration) of blood cells

- **Hypersplenism**
- **SLE**

II) Destruction of cells within the marrow

- **Megaloblastic anemia**
- **Myelodysplastic syndrome (MDS)**
- **Hemophagocytic lymphohistiocytosis (HLH)**

III) Decreased production of cells by the marrow

a) Aplasia or hypoplasia of the marrow

- **Aplastic anemia**
- **Hypoplastic acute leukemia**
- **Hypoplastic myelodysplasia**
- **Fanconi anemia**

b) Infiltration of the marrow

- **Myeloma**
- **Leukemia**
- **Myelofibrosis**
- **Osteopetrosis**
- **Gaucher disease**
- **Secondaries (breast, lung, and prostate)**

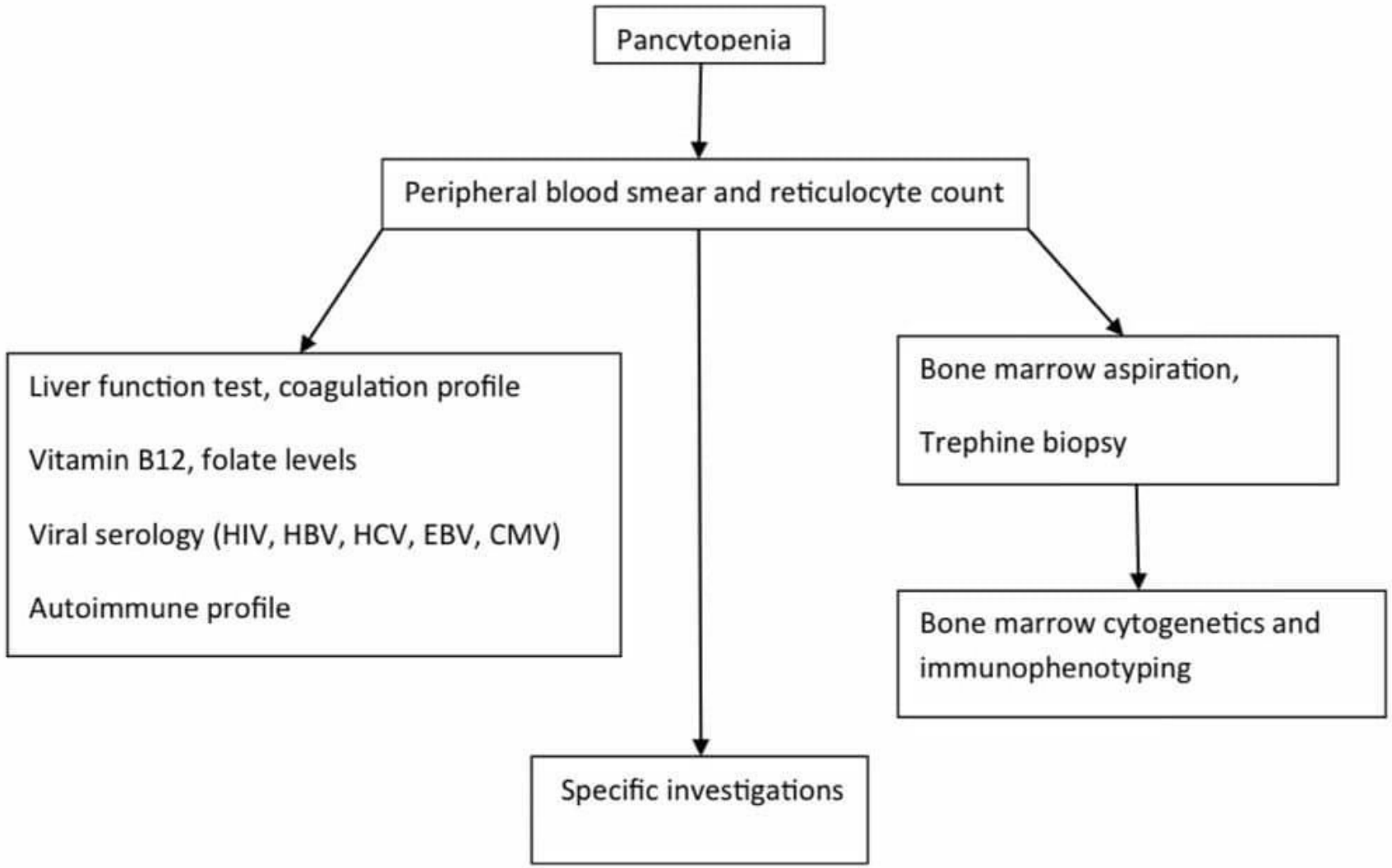
APPROACH

History

- Weakness/fatigue/fever/bleeding/weight loss/anorexia
- Alcoholism/Exposure to drugs, chemicals or radiation
- Cancer/autoimmune disorders/infection

Exam

- Fever/pallor/icterus/petechiae
- Organomegaly/Bone tenderness
- Neurologic manifestations


Pancytopenia
Peripheral blood smear and reticulocyte count
Liver function test, coagulation profile
Vitamin B12, folate levels
Viral serology (HIV, HBV, HCV, EBV, CMV)
Autoimmune profile
Bone marrow aspiration,
Trephine biopsy
Bone marrow cytogenetics and immunophenotyping
Specific investigations

EVALUATION

- Hypersplenism
- Aplastic anemia
- Megaloblastic anemia
- Myelodysplastic syndrome
- Hemophagocytic lymphohistiocytosis
- Marrow infiltration
- Infections (HIV, hepatitis viruses, EBV ,CMV; sepsis, enteric fever, TB)

Hypersplenism

C/P: Splenomegaly

- **Portal hypertension/Underlying cause**

Hemogram: Not severe pancytopenia/Reticulocytosis

- **Normal cell morphology**

Bone marrow: Variable cellularity (normo/hyper)

- **Normal hematopoiesis**

Aplastic Anemia

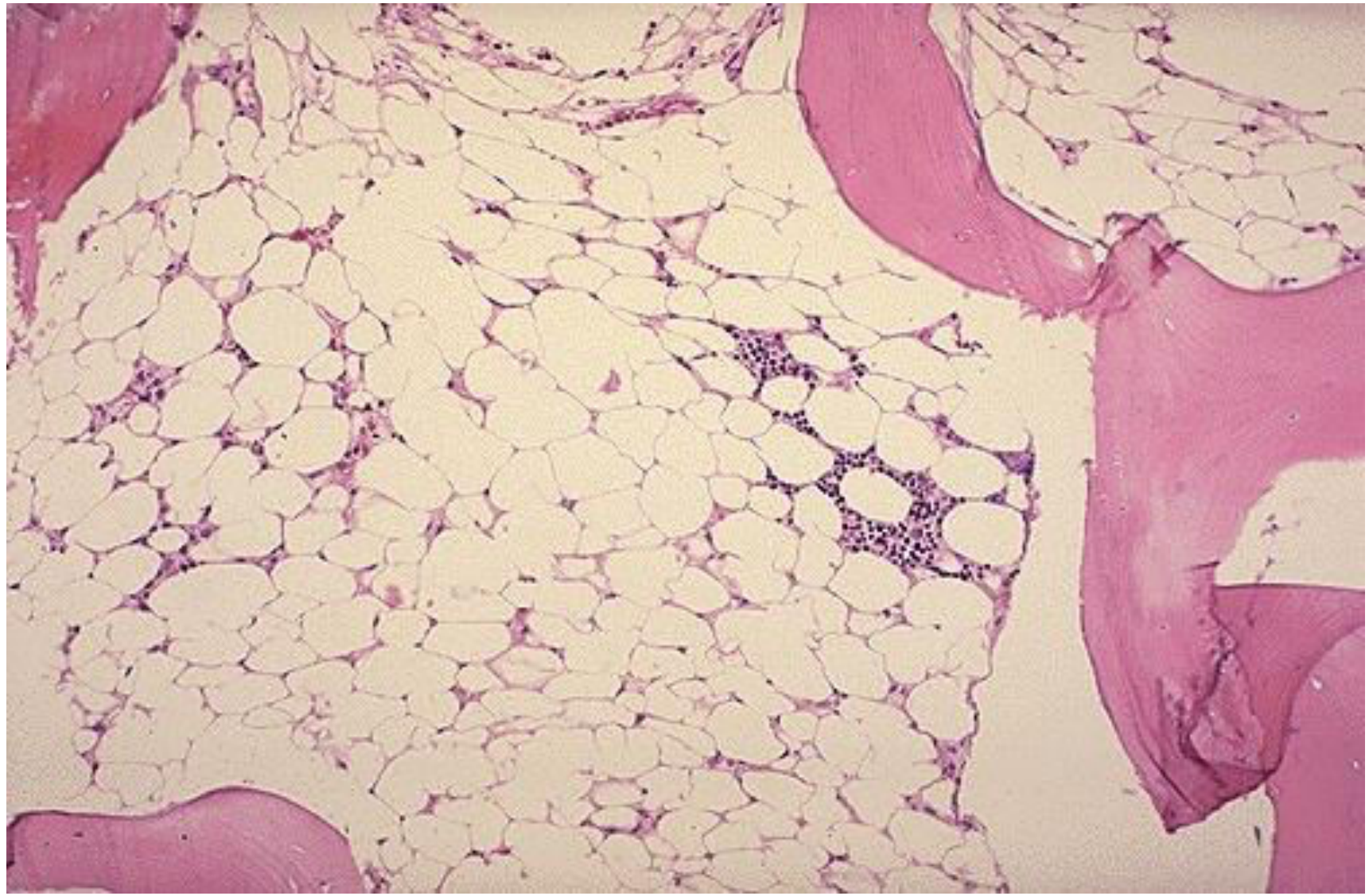
C/P: Anemia, infection, & bleeding

Hemogram: Pancytopenia & reticulocytopenia

- **RBC: Normocytic normochromic/Slightly macrocytic**

Bone marrow: Hypocellular

- **Mostly fat**



Megaloblastic Anemia

C/P: Anemia, mild jaundice and glossitis.

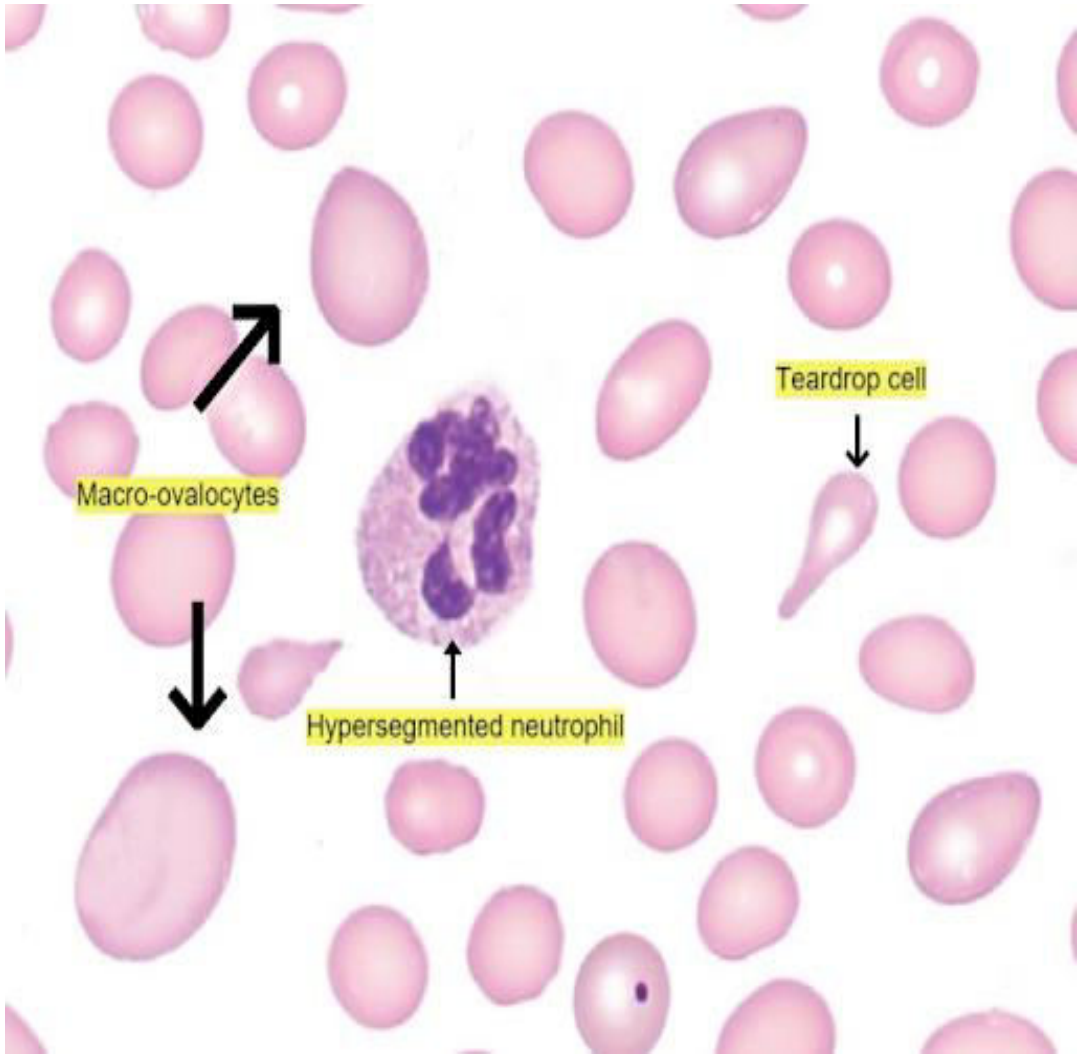
- **Vit. B12 deficiency with neurologic manifestations**

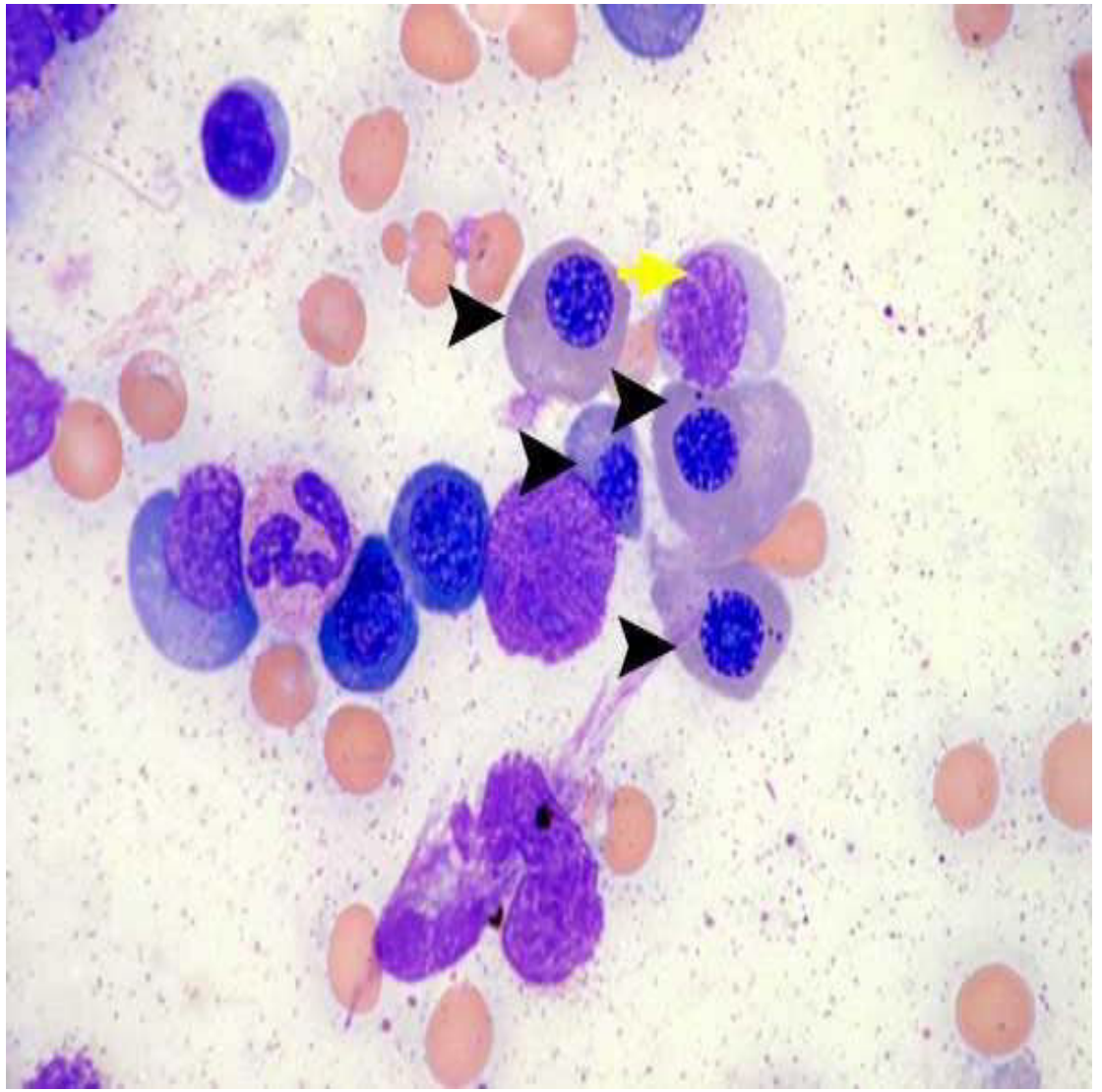
Hemogram: Pancytopenia, & reticulocytopenia

- **Abnormal morphology of RBC, & WBC**

Bone marrow: Hypercellular

- **Megaloblastic & ineffective hematopoiesis**


Macro-ovalocytes
Teardrop cell
Hypersegmented neutrophil



- **Serum bilirubin: Elevated**
- **Serum lactate dehydrogenase: Elevated**
- **Serum antibodies to intrinsic factor: Pernicious anemia**
- **Vit. B12 deficiency: Low serum Vit. B12 levels;**

  Raised serum homocysteine and methylmalonic acid levels
- **Folic acid deficiency: Low serum or red cell folate levels;**

  Raised serum homocysteine levels

Myelodysplastic Syndromes (MDS)

C/P: Anemia, infection, & bleeding

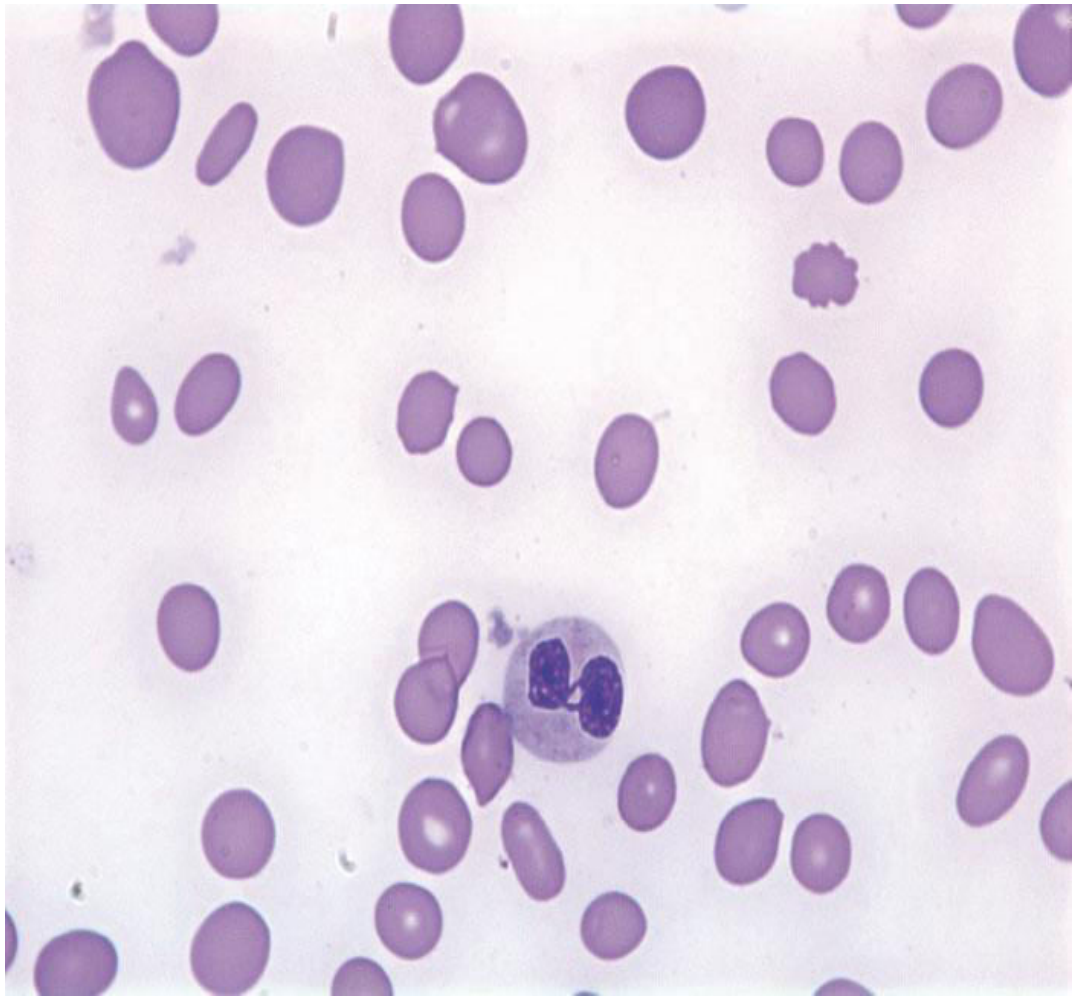
Hemogram: Pancytopenia & reticulocytopenia

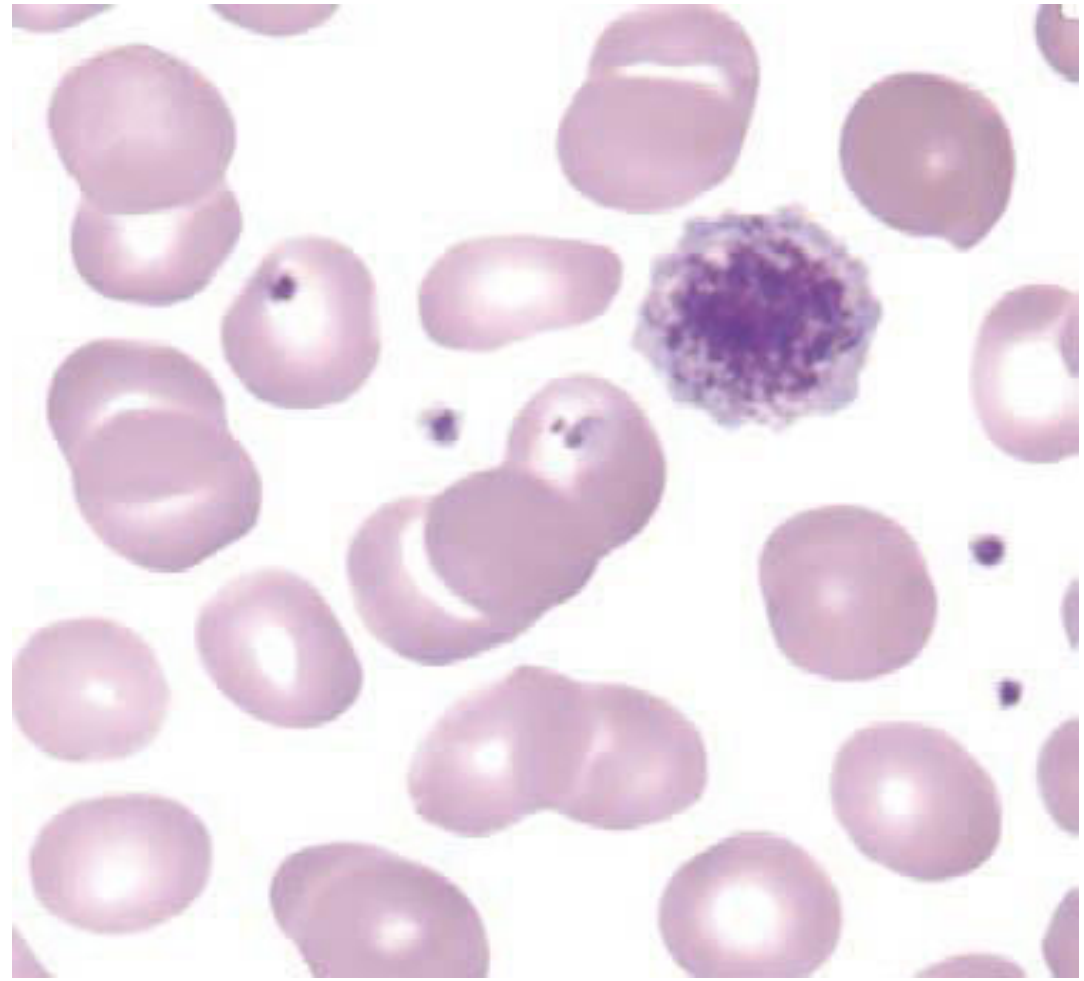
- **Abnormal morphology of cells**

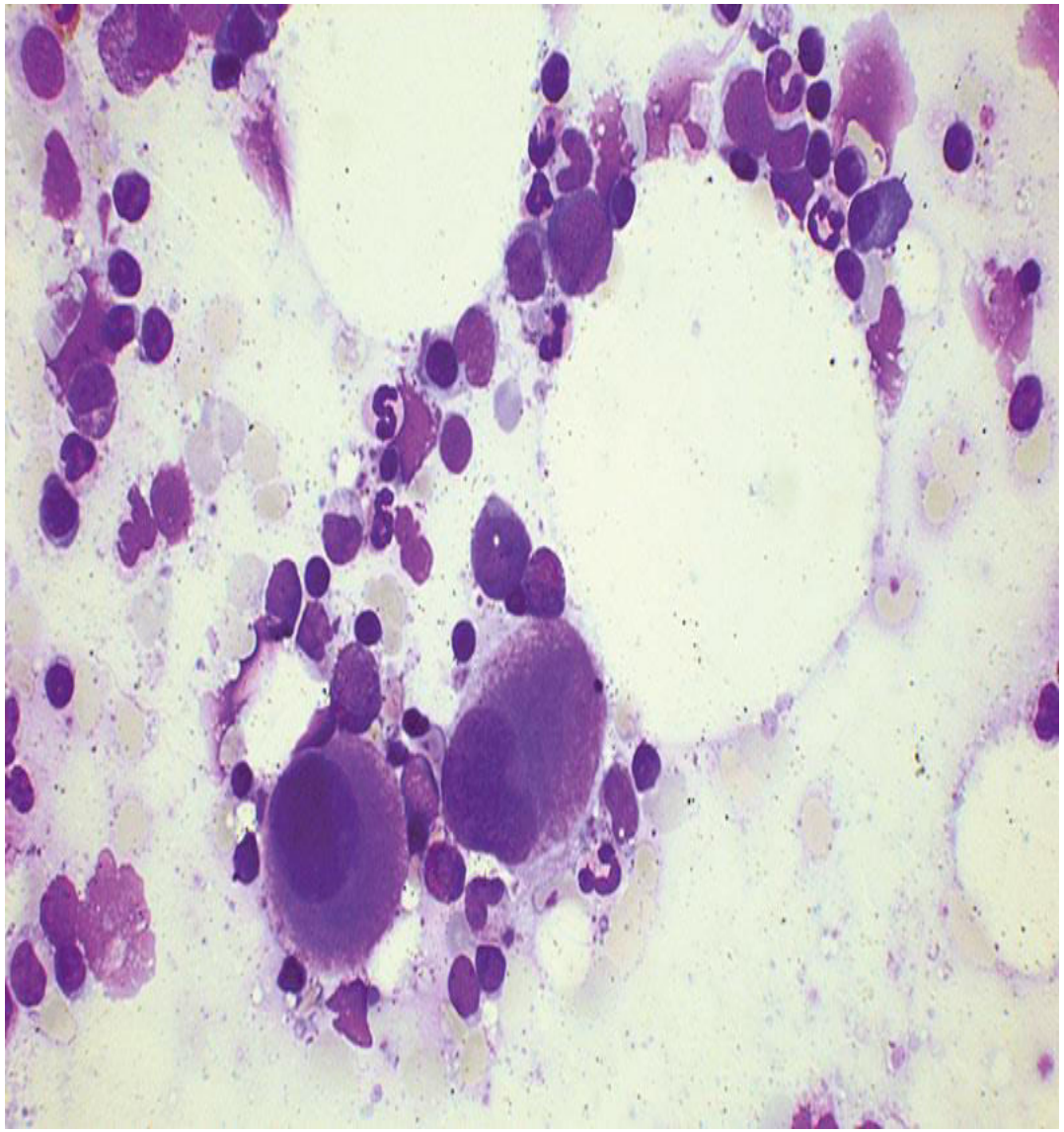
Bone marrow: Hypercellular

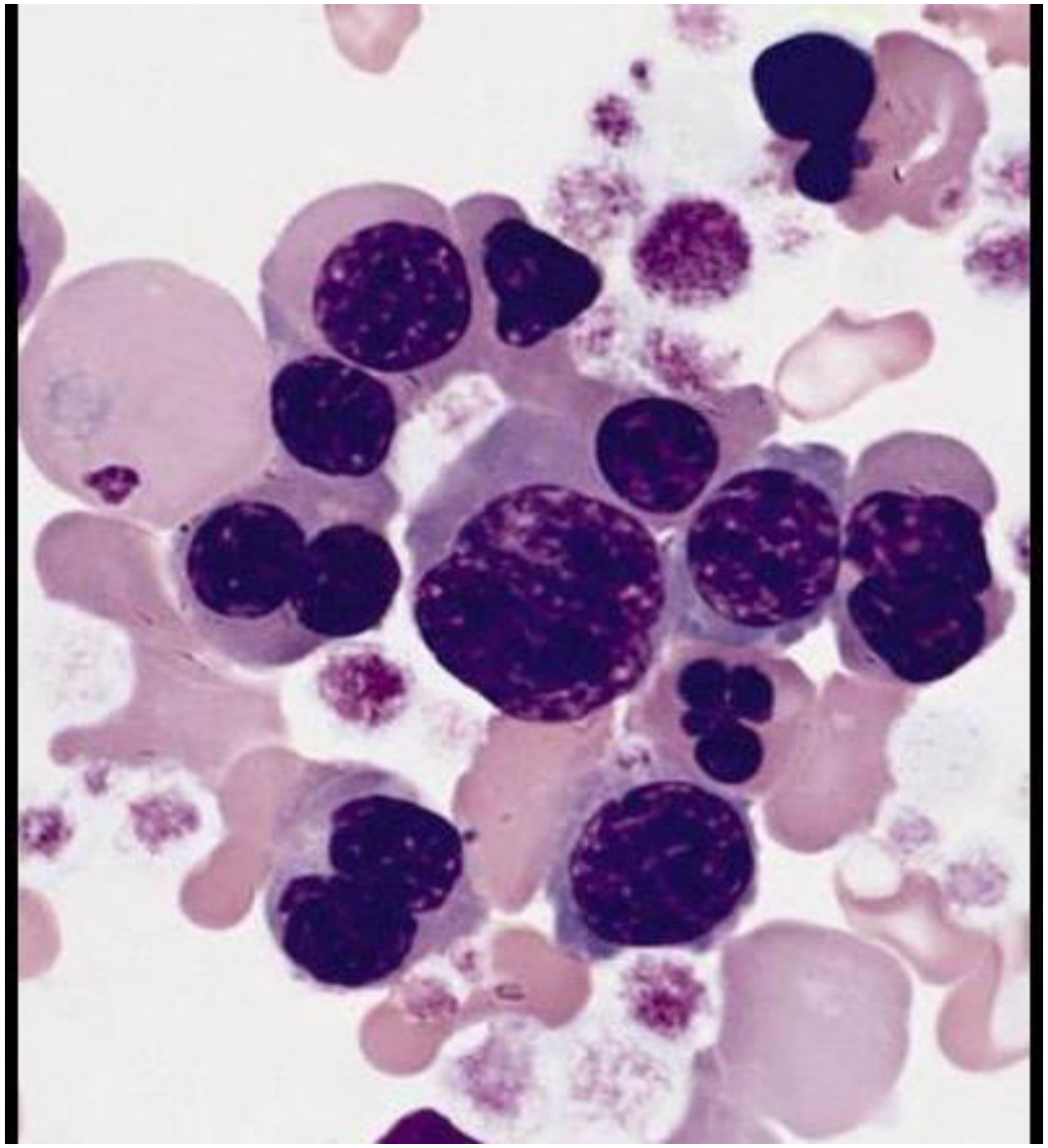
- **Dysplastic & ineffective hematopoiesis**

Cytogenetic studies and immunophenotyping









Hemophagocytic Lymphohistiocytosis (HLH)

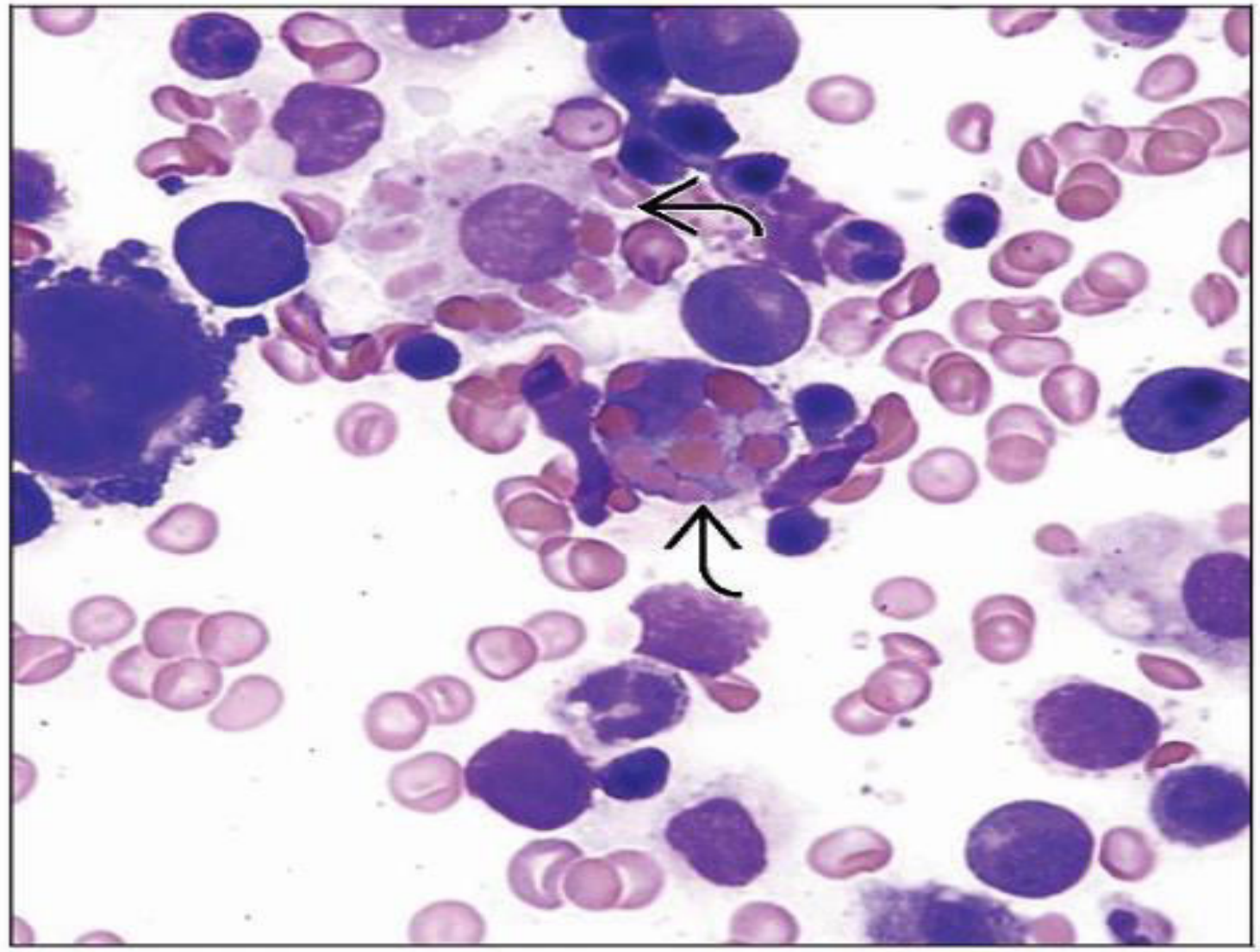
C/P: Fever, splenomegaly, & jaundice

Hemogram: Profound pancytopenia & reticulocytopenia

- **RBC: Anisopoikilocytosis**

Bone marrow: Variable cellularity (normo/hyer/hypo)

- **Hemophagocytosis by macrophages**



- **Serum ferritin: Elevated**
- **Serum triglycerides: Elevated**
- **Fibrinogen: Decreased**
- **Serum soluble CD 25: Elevated**
- **LFTs: Abnormal**

Marrow Infiltration

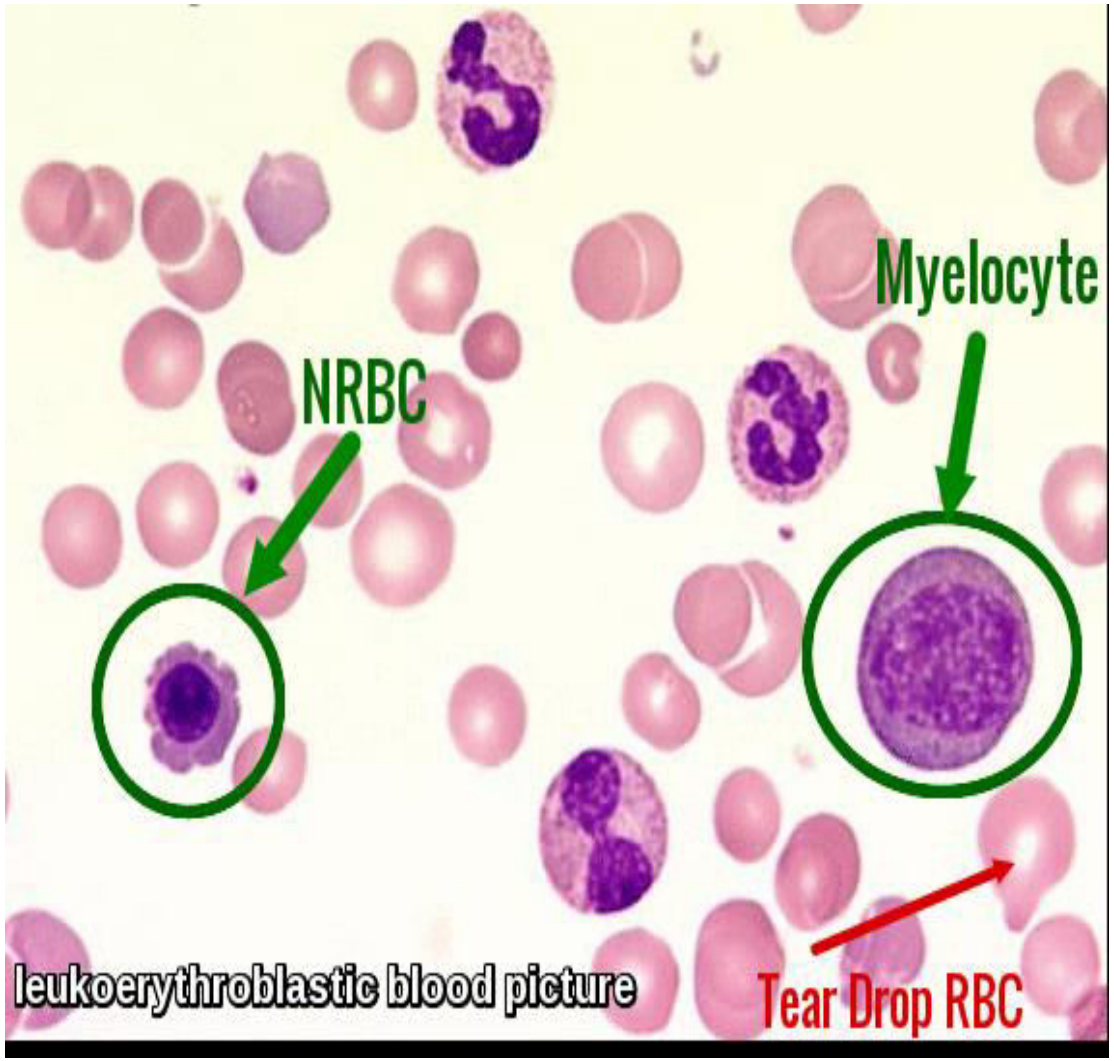
C/P: Variable/Underlying cause

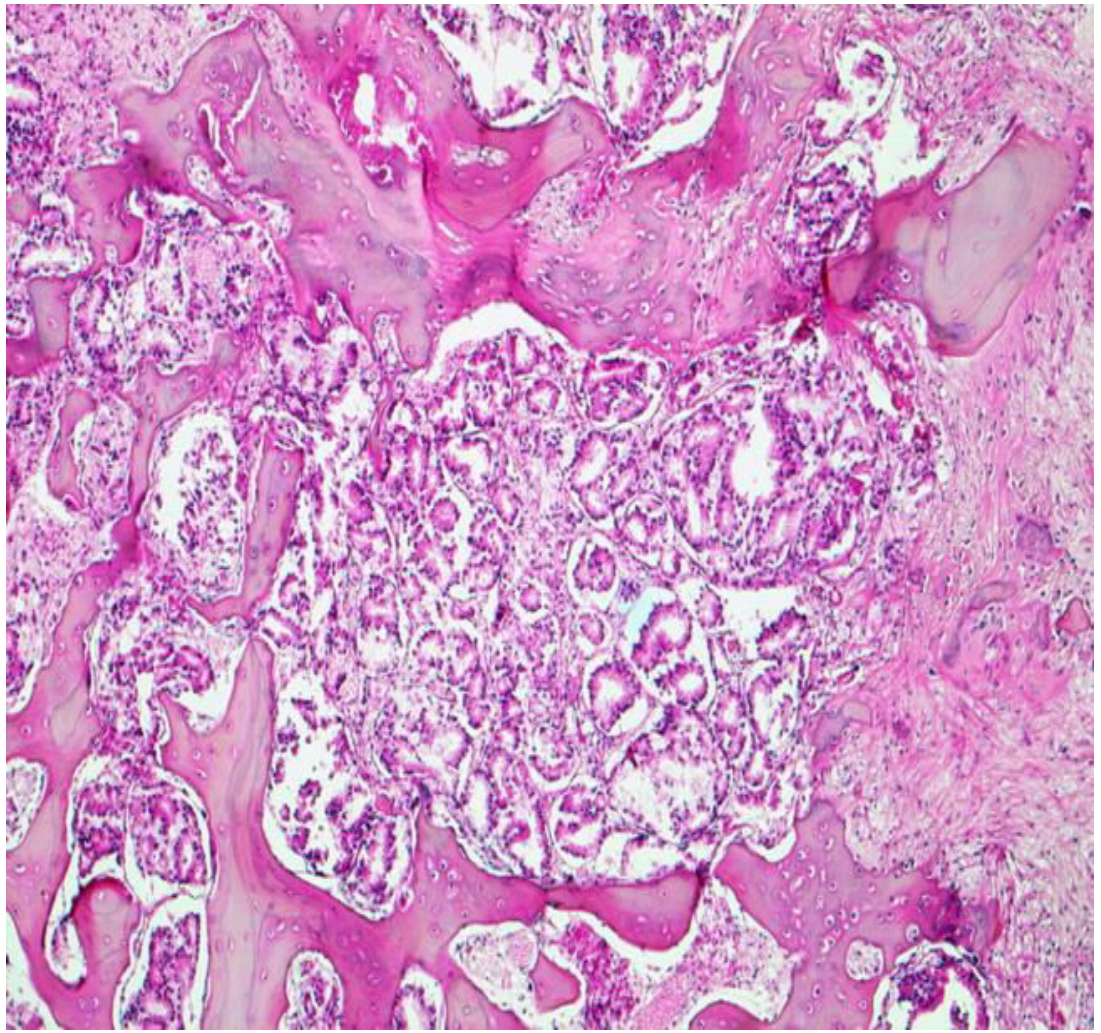
Hemogram: Pancytopenia & reticulocytopenia

- **Underlying pathology**
- **Tear drop cells/Leukorythroblastic reaction**

Bone marrow: Variable cellularity (normo/hyper/hypo)

- **Abnormal cells/Underlying pathology**


Myelocyte
NRBC
leukoerythroblastic blood picture
Tear Drop RBC



A 32-year-old man presents with mild fever and increasing fatigue. He is an immigrant from Russia and worked in a benzene factory. Physical examination does not reveal lymphadenopathy or splenomegaly, but petechial skin lesions are noted. A CBC demonstrates severe pancytopenia, with normocytic red cell indices. Bone marrow biopsy appears hypocellular with mostly fat.

A 62-year-old man is taken to the emergency department in a state of inebriation. He is well known there because this scenario has been repeated many times over 15 years. On physical examination, he is afebrile. The spleen tip is palpable, and the liver edge is firm. Laboratory studies show hemoglobin of 8.2 g/dL, hematocrit of 25.1%, MCV of 107 µm3, platelet count of 135,000/mm3, and WBC count of 3920/mm3. The peripheral blood smear shows prominent anisocytosis and macrocytosis. Polychromatophilic RBCs are difficult to find. A few of the neutrophils show six to seven nuclear lobes.